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[54] **CARBURETTORS FOR INTERNAL COMBUSTION ENGINES**

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[58] **Field of Search** ..... 123/406, 407, 434, 437; 261/44 A, 44 D, 50 A

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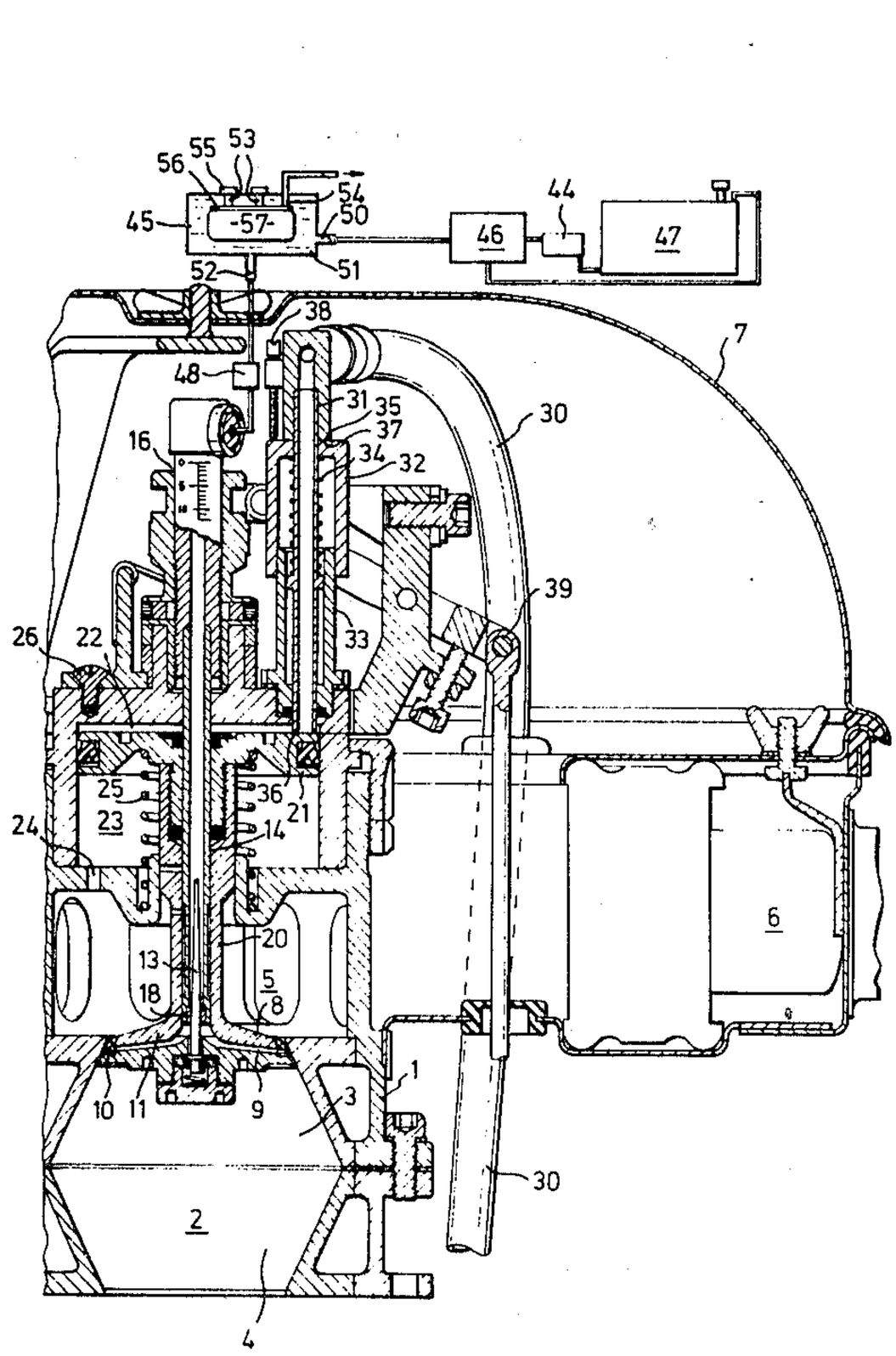
[57] **ABSTRACT**

A carburettor for an internal combustion engine has an air passageway in which air flow is controlled by a poppet valve in which fuel is fed from a tapered needle controlled valve readily variable for different fuels including CNG, LPG, Methanol and petrol. A movable assembly comprises the poppet valve connected to a movable wall, the latter separating a first and second pressure chamber and a low pressure control valve is manually programmable to take up a position relative to the movable assembly preferably the movable wall to control pressure in the first pressure chamber against a balancing pressure in the second pressure chamber and a biasing means to control the position of the poppet valve and the fuel valve and hence the power of an internal combustion engine on which the carburettor is fixed in accordance with selected positions of a manual control.

19 Claims, 5 Drawing Figures



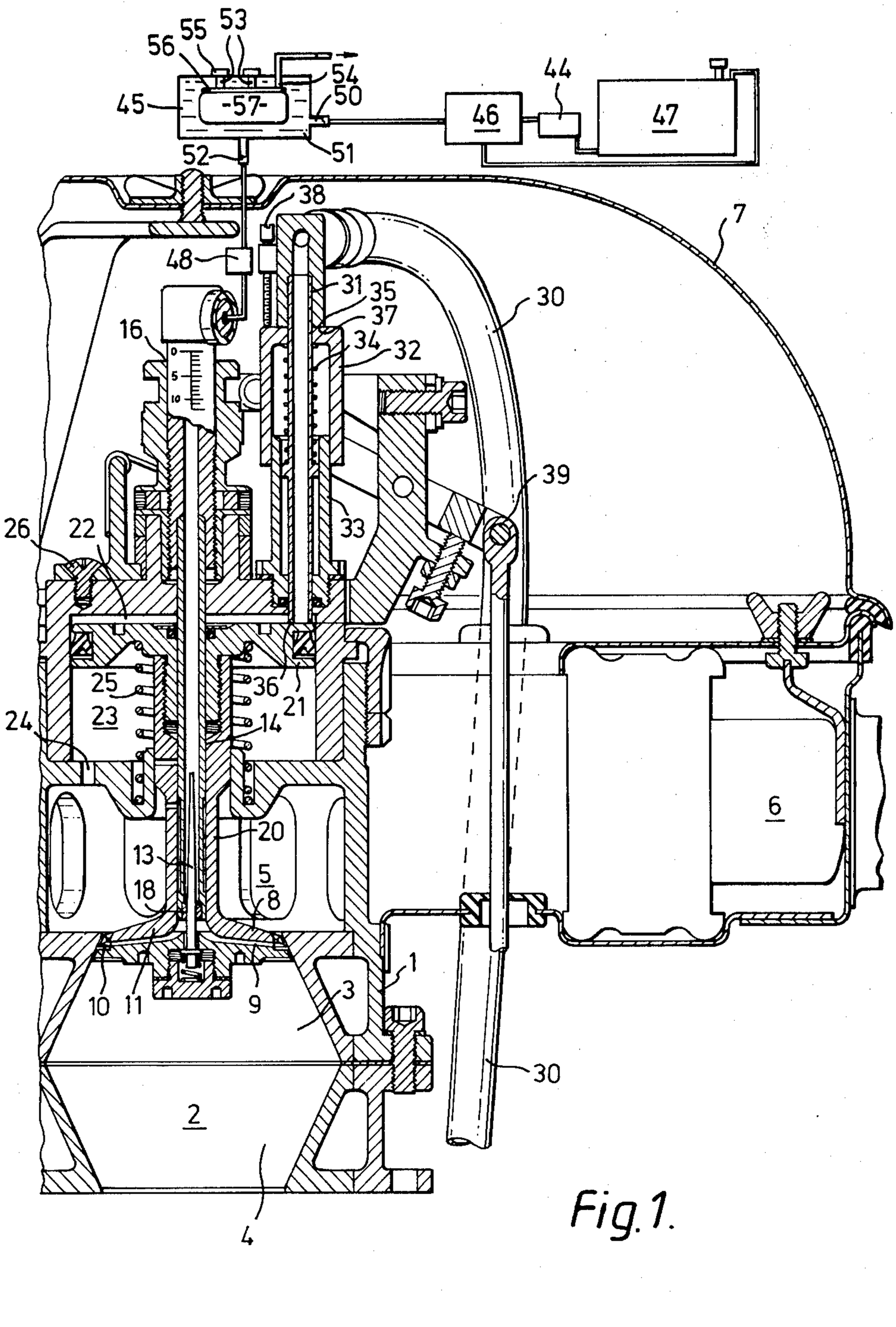

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Fig.1.

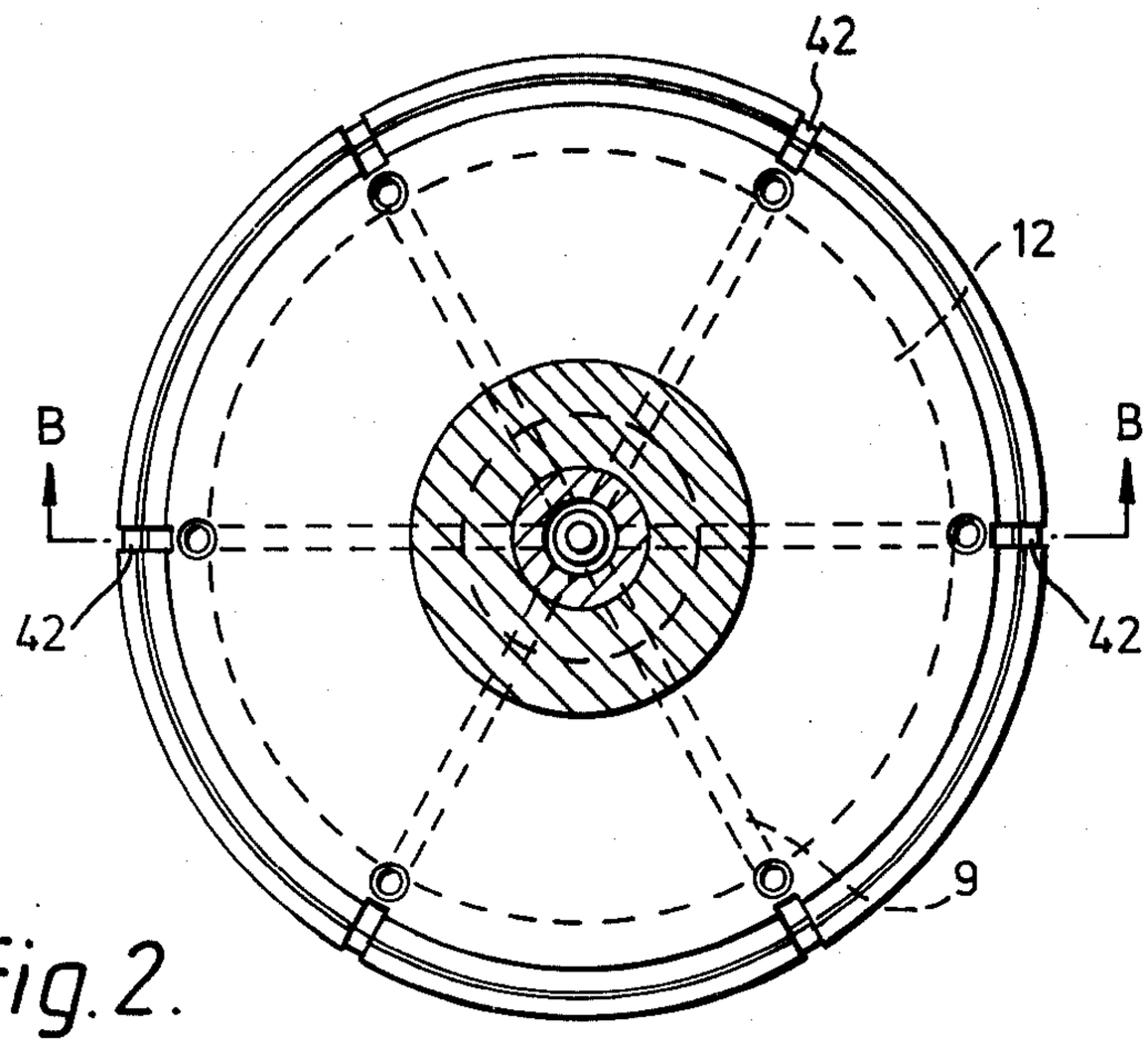


Fig. 2.

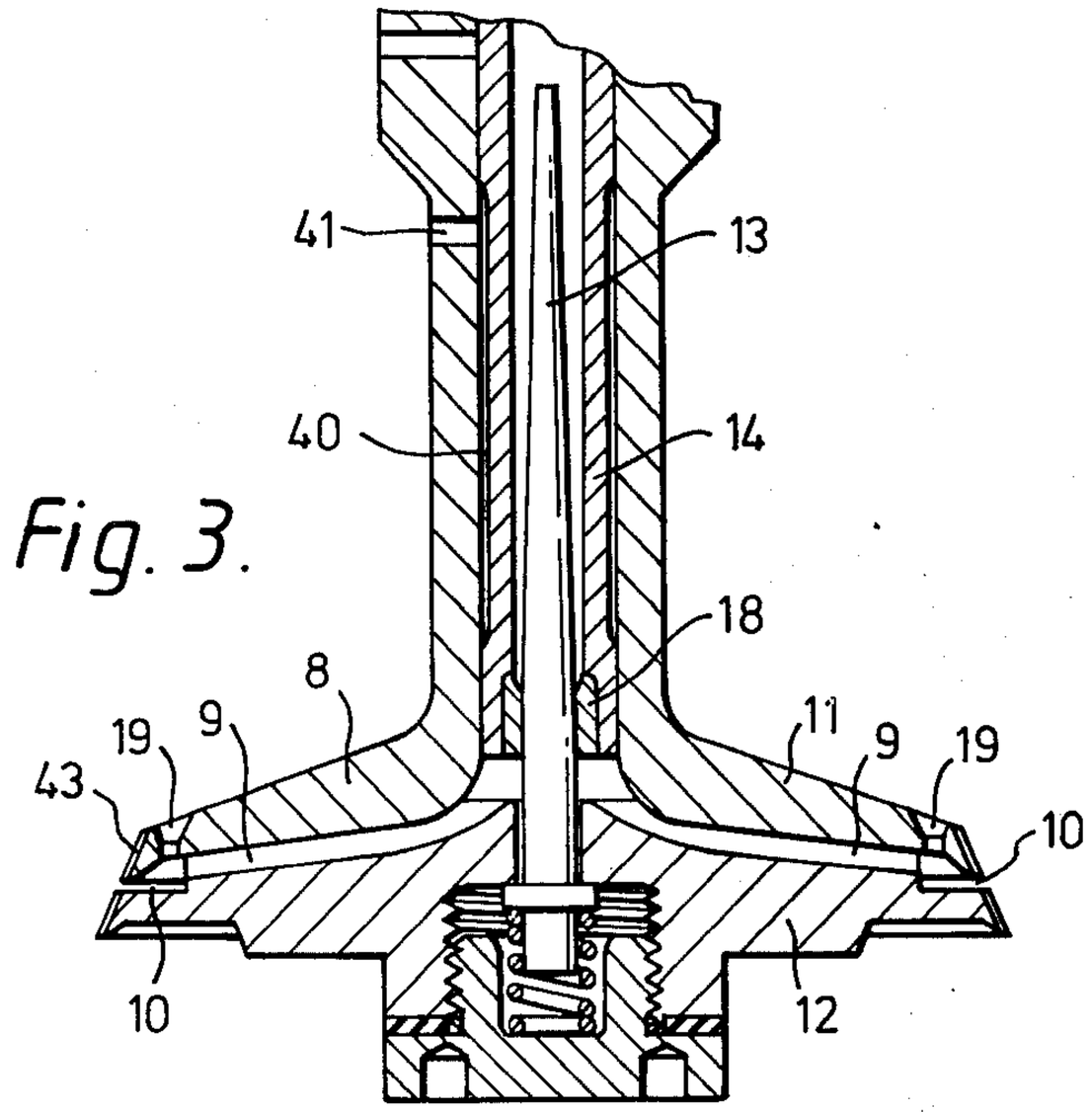


Fig. 3.

Fig.4.

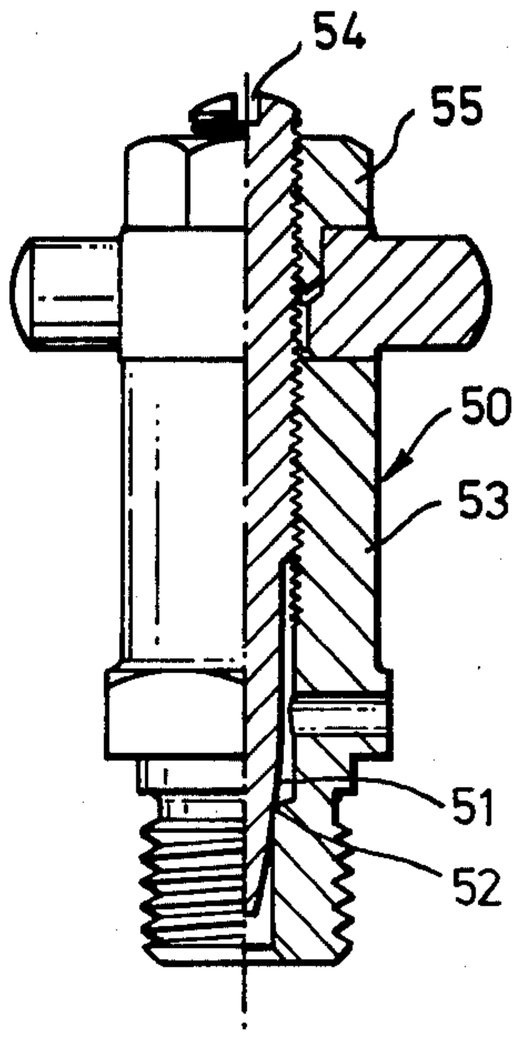
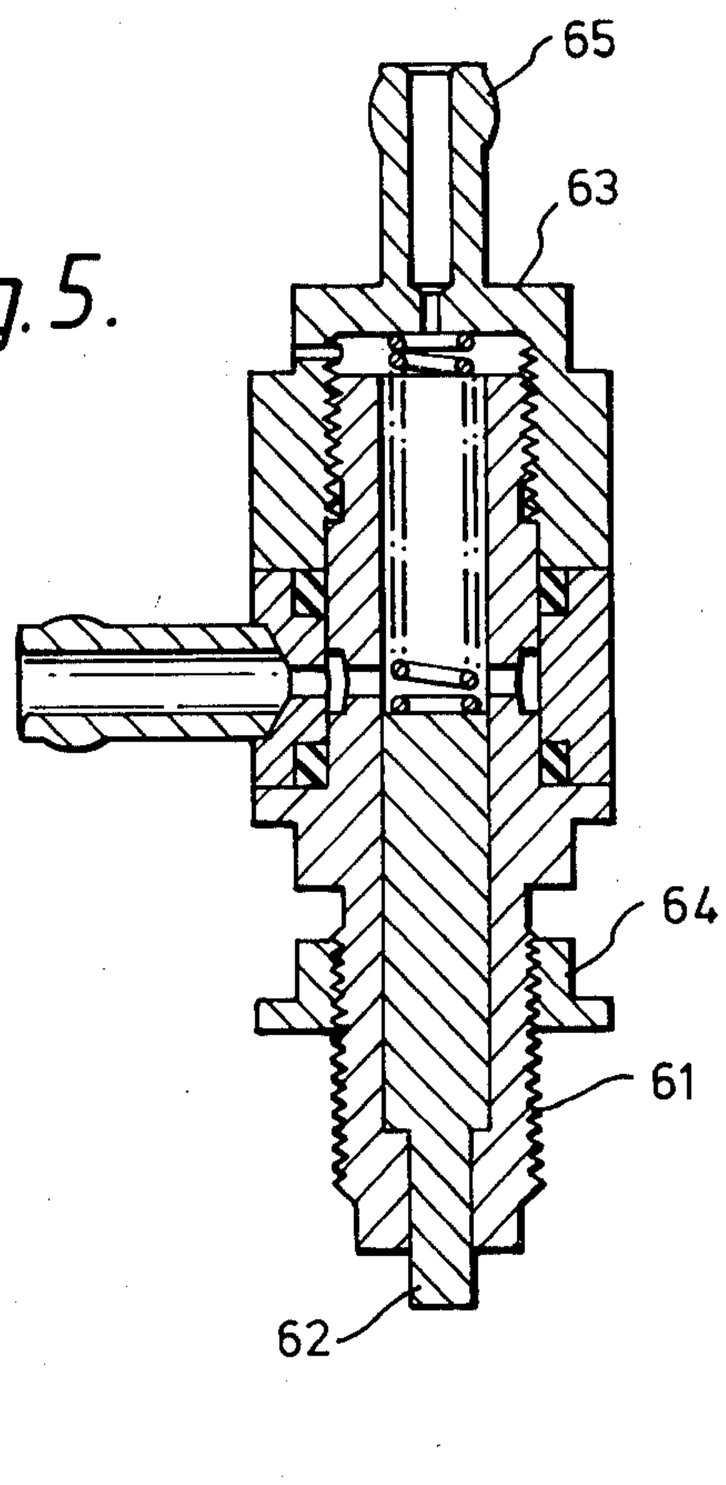


Fig.5.



CARBURETTORS FOR INTERNAL COMBUSTION ENGINES

This invention relates to carburettors for internal combustion engines.

It is an object of the present invention to provide a carburettor for an internal combustion engine which will at least provide the public with a useful choice.

Accordinglay in one aspect the invention consists in a carburettor for an internal combustion engine comprising a body, an air passageway therethrough, leading in use from ambient air to the internal combustion engine and including a venturi tube therein, a movable air control valve member in or adjacent said venturi tube and forming part of a movable assembly, a fuel control valve member associated with said air control valve member, a movable wall connected to but spaced away from said air control valve member so as to be movable therewith and so as to form part of said movable assembly, said movable wall separating a first and a second pressure chamber in said body, biasing means to bias said movable assembly to a biased position, a low pressure conduit between a part of said air passageway in which engine vacuum exists in use and said first pressure chamber, a pressure control entry to said first pressure chamber, a balancing pressure entry to said second pressure chamber, a low pressure control valve member controlling pressure from said low pressure conduit to said first pressure chamber and positionable relative to a part movable with said movable assembly and manually operable actuating means to programme positioning of said low pressure control valve member so that movement of said movable assembly relative to said low pressure control valve member due to relative forces acting on said movable assembly causes variation of pressures in said first pressure chamber and hence variation of position of said movable assembly including said air control valve member and said fuel control valve member to control power from an internal combustion engine to which the carburettor is fixed in accordance with selected positions of said manually operable actuating means.

To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the descriptions herein are purely illustrative and are not intended to be in any sense limiting.

One preferred form of the invention will now be described with reference to the accompanying drawings in which:

FIG. **1** is a cross section of a carburettor according to the invention, part of an air cleaner being cut away;

FIG. **2** is a plan view of a air control valve member according to the invention; and

FIG. **3** is a cross section on the line B—B, FIG. **3**;

FIG. **4** is an elevation partly in section of an adjustable air valve; and

FIG. **5** is a sectional elevation of an ignition advance and retard control valve.

Referring to the drawings, a carburettor constructed according to the invention has a body **1**, in which there is provided an air passageway generally referenced **2** and to provide a venturi tube therein, a coned mixture intake section **3** is connected through a reversed cone section **4** to the manifold of an internal combustion engine (not shown). Because there may be considerable

evaporation of fuel in the sections **3** and **4**, resulting in lowering of temperature, these sections are preferably heated by passing exhaust gases or preferably hot water from a water cooled engine cooling system through a jacket surrounding sections **3** and **4**. The coned section **3** leads from an air intake **5** which is fed through an air filter shown diagrammatically at **6** and associated with the carburettor cover **7** parts of the filter **6** and cover **7** are cut away in the drawing. Mounted in the mixture intake section **3** is a movable air control valve member **8**, the valve member **8** having radial passages **9** leading to a preferably annualar groove or channel **10**. Such channel may be of simply annular or may be of zig-zag or undulating formation e.g. varying in diameter or in plane, and for some purposes a plurality of channels may be used. The valve is formed in two parts **11** and **12** held together with screws and the part **12** adjustable carries a jet needle **13** inserted in a fuel supply tube **14**. To assist fuel flow air pasages **40** lead air from air intake **5** through air entry apertures **41** past the fuel passing from the jet **18**. The fuel supply tube **14** is adjustable up and down as to engagement with the needle **13** and after adjustment is fixed by a clamp **16**, fuel being supplied from a pressurized source of fuel through a movable e.g. flexible tube **17**. It is a feature of the invention in the preferred form that by thihs arrangement different types of fuel may be adjusted for by adjusting the fuel pressure and/or by adjusting the fuel tube **14** up or down and it is believed that different fuels such as CNG,LPG,methanol, ethyl alcholol, gasohol and even fluid entrained solid fuel such as finely powdered coal could be supplied through the carburettor according to the invention.

Fuel is supplied to fuel supply tube **14** from the pressurized fuel supply, the pressure being determined by the viscosity and energy value of the selected fuel or blend of fuels. For petrol a standard automatic fuel pump taking supply from a petrol tank **47** is generally acceptable but for other fuels e.g. methanol or ethanol a higher presure pump is desirable. The fuel pump **44** supplies pressurized fuel preferable with the addition of a vapour separator **45**, a pressure control valve **46** and a fuel shut-off valve **48**.

The vapour separator **45** has a fuel inlet **50** at a suitable level in a float chamber **51** and a fuel outlet **52** in a lower part of chamber **51**. Two studs **53** and the lower orifice **54** of an air vent **55** abut against a flat annular seal **56**, firstly to keep the float **57** level and secondly, the float **57** acting on seal **56** controls the escape of air from above the floor through air exit **58**. Such vapour laden air is then delivered by a pipe (not shown) to a convenient place e.g. air intake **5**. The fuel pressure valve **46** is any proprietary pressure control valve able to control the pressure within desired limits and the fuel shut-off valve **48** may be a solenoid or a mechanically actuated valve to shut-off fuel supply completely when it is desired to shut down the engine.

Valve member **9** is shown in more detail in FIGS. **2** and **3** where the shape of the annular groove or channel **10** is shown in more detail and the jet nozzle **18** is shown which coacts with the needle **13** to give varying rates of flow of fuel as will be described further shortly. Also shown are air entry holes **19** in the air intake side of the air control valve member **8** which connect with the radial passages **9** for the purpose of accelerating and breaking up the fuel as it enters the peripheral fuel distribution channel **10**. Slots or notches **42** are provided in the bevelled edge **43** preferably at the junction of the

radial passages **9** and the channel **10** to assist starting and idling of the engine.

To form a moving assembly the valve member **8** is connected by a valve spindle **20** to a pressure sensitive or movable wall member which may be a piston **21** operating in a piston chamber as shown or which may be a diaphragn if desired. The piston chamber is divided into a first upper chamber **22** and a second lower chamber **23**. The second chamber **23** is connected by a balancing pressure entry comprising a passageway **24** to the ambient atmosphere in air intake **5**. A spring or other biasing means **25** biases the piston **21** towards the chamber **22** and also biases the air control valve member **8** to a biasing position substantially closing off air entry to the engine. If desired an adjustable stop acting for example against the top of piston **21** may be provided to control the closed position. The chamber **22** has a pressure control entry comprising an air bleed hole **26** which connects ambient atmosphere with the interior of first chamber **22**. Various sizes of bleed holes may be provided to tune the carburettor, but preferably an adjustable valve **50** (FIG. **4**) is provided having a tapered valve member **51** acting adjacent a valve seat **52** and adjustably threaded in the body **53**. A slot **54** and lock nut **55** are provided to enable adjustment and locking to be effected.

To provide manually operable actuating means to programme positioning of a low pressure control valve member, a movable, e.g. flexible tube **30** is connected to a part of the air passageway **2** in which engine vacuum exists in use, e.g. to a connecting piece (not shown) leading to the engine manifold at a position below the connecting piece **4** so that engine vacuum is supplied through a lost motion device comprising a slidable tube **31** connected to a carrier **32**, the carrier **32** and tube **31** sliding on a carrier support **33**. A biasing means e.g.a spring **34** is positioned between the carrier **32** and the tube **31**. The lower end **36** of the tube **31** forms part of the low pressure control valve means and bears against the upper surface of the piston **21** which thus forms a valve seat for the low pressure control valve means. When the lower end **36** is in contact with the piston **21** there will be substantially no fluid flow through the tube **31**. The carrier **32** is movable by a manually operable (e.g. usually operable by the accelerator in a motor vehicle) throttle linkage generally referenced **39** and pressure is transmitted from the carrier **32** through the spring **34** to the tube **31** to vary the position of that tube according to throttle demands and the position of the piston **21**. The relative positions of tube **31** and carrier **32** are determined when there is no lost motion present by shoulder **35** on the tube **31** contacting shoulder **37** on the carrier **32** being held there by spring **34**, or preferably by a screw **38** which adjustably varies a gap between shoulders **35** and **37**. When there is lost motion present i.e. when spring **35** is compressed, by end **36** contacting the top of piston **21**.

Preferably in air ignition advance and retard control valve is provided mounted on the body **1** by a male thread **61** (FIG. **5**) so that a valve actuating member **62** is contacted by the top of piston **21** when the movable assembly is in the biased or closed disposition. The reach of the valve body **63** is adjustably locked by use of lock nut **64**. The body **63** has a vacuum inlet **65** connected to engine vacuum and vacuum outlet **66** connected to an ignition advance and return mechanism such as a diaphragm (not shown). A valve member **67** is spring loaded to an open opsition by a spring **68** and when the actuation member **62** is appropriately moved by piston **21** the valve orifice **69** is closed or substantially closed stopping or reducing the vacuum applied to control the ignition advance and retard mechanism.

The operation of the construction is as follows:

The carburettor is mounted on the intake manifold of an internal combusion engine and the fuel tube **14** connected to for example a petrol supply through pump **44**, vapour separator **45** and fuel shut-off valve **48** as above described.

When the engine is at rest the parts are substantially in the position shown in FIG. **1** of the drawings. When the engine is started up a vacuum will be created in the passageway **3** as a result of which the valve member **8** will be drawn downwardly against the pressure of spring **25** and against air pressure admitted to chamber **23** through the passageway **24**. The vacuum is however also transmiteed through tubes **30** and **31** into the chamber **22** so that there will be some balancing effect if surface **36** of tube **31** is not in contact with the upper surface of piston **21**. Because the piston **21** has a greater surface exposed to vacuum in chamber **22** than the surface of the valve member **8** exposed to vacuum in passageway **1**, there will be a tendency for the position of the valve member **8** to be fixed by the positioning of the tube **31** against the upper surface of piston **21**, i.e. will depend on throttle setting. This position i.e. as shown in the drawings will give minimum fuel supply i.e. idle conditions for the engine. Fuel and air supplied will depend on the position of jet **18** relative to needle **13** and air valve member **8** relative to the walls of cone **3** respectively. The fuel flow is accelerated by the flow of air from passages **40** past jet **18** and is broken up and accelerated by air flow through apertures **19** in air control valve **8**. The fuel is engaged substantially evenly around the circumference of air control valve **8** by the suction of the air flow past the edge **43** thereof giving adequate atomization in the fuel mixture. It is of course an advantage that because both fuel and air are controlled by positioning the moving assembly no butterfly valve is necessary.

It if is required to increase the power supplied by the engine, the throttle linkage **39** is moved to move the carrier **32** downwardly increasing spring pressure against the tube **31** and the end **36** of the tube **31** will accordingly to programmed to close against piston **21** reducing vacuum in the chamber **22**, and to stay in the closed position until all lost motion in the lost motion device is taken up. As a result the relevant forces acting on the movable assembly are as follows. There will be a greater vacuum in passageway **3** compared with chamber **22** which will overcome the air pressure in chamber **23** and spring pressure from the spring **25**. As a result the positon **21** will move downawardly and the tube **31** will follow that downward movement and bleed hole **26** will maintain air pressure in chamber **22** until a position is reached where piston **21** moves away from end **36** of tube **31**, i.e. all lost motion in the lost motion device has been taken up, the vacuum in passageway **2** changes due to the engine demand increasing the vacuum and as a result air will be drawn off from the first chamber **22** faster than it can be supplied through bleed hole **26**. As a result there will be an equilibrium position in which it is believed that piston **21** is maintained a very short distance below the end **36** of tube **31** where the bleed-conditions in first chamber **22** maintain the valve member **8** in a constant position for that particular power setting. This power setting of course controls the posi-

tion of the needle 13 relative to the fuel jet orifice 18 and the amount of air admitted to passageway 2 and thus the engine from the air intake 5.

A decrease in engine revolutions per minute through increased load on the engine while in a fixed throttle setting causes a reduction in engine vacuum resultING in a reduction in vacuum (increase in pressure) in first chamber 22 as a result of which the movable assembly moves to increase both air and fuel flow untiol equilibrium is again restored.

It will be clear from the foregoing that the invention at least in the preferred form provides the following advantages:

1. Sensitivity of control with automatic fuel and air supply increases for a particular setting of the manually operable actuating means. A reduction in engine revolutions per minute due to load increase results in reducing vacuum giving increased fuel and air valve settings.

2. Capability of being quickly adjusted to various fuels and to different sized engines by adjustment of the fuel supply jet relative to the tapered fuel supply needle.

3. Good fuel atomization and vapourization because of the radial fuel passages and peripheral fuel channel assisted by the augmentation of fuel flow by air flow over the jet and the flow of air into the peripheral channel on the periphery of the air control valve.

4. Good air flow due to the absence of a butterfly control valve in the air passage.

What is claimed is:

1. A carburettor for an internal combustion engine comprising a body, an air passageway therethrough, leading in use from ambient air to the internal combustion engine and including a venturi tube therein, a movable air control valve member in or adjacent said venturi tube and forming part of a movable assembly, a fuel control valve member associated with said air control valve member, a movable wall connected to but spaced away from said air control valve member so as to be movable therewith and so as to form part of said movable assembly, said movable wall separating a first and second pressure chamber in said body, biasing means to bias said movable assembly to a biased position, a low pressure conduit between a part of said first pressure chamber, a pressure control entry to said first pressure chamber, a balancing pressure entry to said second pressure chamber, a low pressure control valve member controlling pressure from said low pressure conduit to said first pressure chamber and positionable relative to a part movable with said movable assembly and manually operable actuating means to programme positioning of said low pressure control valve member so that movement of said movable assembly relative to said low pressure control valve member due to relative forces acting on said movable assembly causes variation of pressures in said first pressure chamber and hence variation of position of said movable assembly including said air control valve member and said fuel control valve member to control power from an internal combustion engine to which the carburettor is fixed in accordance with selected positions of said manually operable actuating means.

2. A carburettor as claimed in claim 1 wherein said manually operable actuating means include a directly movable member the position of which is manually set to a selected predetermined position by manual actuation and a lost motion device connected between said directly movable member and said low pressure control valve member so that control of pressure in said first pressure chamber by said low pressure control valve member is influenced by the presence or absence of lost motion within said lost motion device, the presence of lost motion inhibiting control of pressure in said first pressure chamber by said low pressure control valve member.

3. A carburettor as claimed in claim 2 wherein said lost motion device includes a biasing means between said directly movable member and a tube forming part of said low pressure conduit, said tube being movable relative to said directly movable member between limits provided by stops.

4. A carburettor as claimed in claim 1 wherein said low pressure control valve member comprises a member surrounding an orifice leading from said low pressure conduit and a surface of said moving wall exposed to pressure in said first pressure chamber provides a valve seat for said low pressure control valve member.

5. A carburettor as claimed in claim 1 wherein said fuel control valve member comprises a tapered needle fixed to said movable assembly which coacts with a fuel jet so that varying amounts of fuel are admitted by movement of said movable assembly and hence said tapered needle relative to said jet.

6. A carburettor as claimed in claim 5 wherein said jet is mounted on a tube and said tube is adjustable in said body to vary the setting of said jet according to the demands of selected fuels and engines.

7. A carburettor as claimed in claim 5 wherein at least one air entry air passageway and air exit are provided to cause a flow of air to pass said jet to augment flow of fuel from said jet.

8. A carburettor as claimed in claim 5 wherein fuel from said jet is passed through radial pasageways in said air control valve member to a peripherl groove on the outer edge of said air control valve member.

9. A carburettor as claimed in claim 8 wherein air entry apertures are provided adjacent the periphery of said air control valve member leading to said peripheral groove.

10. A carburettor as claimed in claim 5 wherein slots are provided adjacent the periphery of said air control valve member to admit air and fuel for starting and idling purposes.

11. A carburettor as claimed in claim 5 wherein said tapered needle is adjustable relative to said movable assembly.

12. A carburettor as claimed in claim 1 wherein said movable wall comprises a piston operating in a cylinder.

13. A carburettor as claimed in claim 1 wherein said biasing means to bias said movable assembly to a biased position comprises a spring biasing said movable assembly and thus said air control valve member to a substantially closed disposition

14. A carburettor as claimed in claim 1 wherein said pressure control entry comrises a passageway leading to atmosphere.

15. A carburettor as claimed in claim 14 wherein sid passageway is provided with an adjustable valve.

16. A carburettor as claimed in claim 1 wherein said balancing pressure entry comprises a passageway leading from said air entry.

17. A carburettor as claimed in claim 1 wherein said venturi tube comprises a coned portion of said air passageway in which a larger diameter portion is down stream of a smaller diameter portion thereof and an inverted cone portion abutting said coned portion with

the larger diameter part thereof upstream of the smaller diameter part thereof.

18. A carburettor as claimed in claim **1** wherein an ignition advance and retard control valve is provided having a valve actuating member actuated by said movable assembly to restrict vacuum applied to a distributor moving means when said movable assembly is at or near said biased position.

19. A carburettor as claimed in claim **18** wherein said ignition advance and retard control valve comprises a body, a vacuum inlet and a vacuum outlet, a spring loaded vavle member actuating said valve actuating member so that when said movable assembly is at or near said biased position, said spring loaded valve member takes a substantially closed disposition.

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